NOAA SECTORAL APPLICATIONS RESEARCH PROGRAM (SARP)
PROJECT ANNUAL REPORT (DRAFT)

PROJECT TITLE
From Vulnerability to Resilience: Helping People and Communities Cope with Crisis

INVESTIGATORS
(Research team and full contact information)

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3. **Belizean Field Assistants**: 5 females and 5 males
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PROJECT YEARS: 08/01/2007 - 07/31/2009

TIME PERIOD ADDRESSED BY REPORT *(e.g., August 2002-March 2003)*
August 2007 - April 2008

I. PRELIMINARY MATERIALS

A. Project Abstract *(Limit to one page)*

ABSTRACT

Problem statement: Focusing on communities located within the Mesoamerican Barrier Reef System (MBRS), this project will use a Livelihood Security/Vulnerability (LS/V) framework to determine the dynamic, differential, and spatial patterns of both household and community level vulnerability and to identify associated coping and adaptive strategies to climate-related crises.
The framework conceives of vulnerability and associated adaptive strategies as outcomes of dynamic processes operating at different temporal and spatial scales.

The general aim of the project is to determine what happens when dynamic environmental systems converge with equally dynamic social systems. Specifically, the proposed research will attempt to answer the following questions:

- How do predicted climate change and variability interact with other economic, social, demographic and environmental changes?
- What are the coping strategies of the various vulnerable groups and how might climate change and vulnerability be affected by these coping strategies?
- What are the relationships between local and scientific knowledge and how might these be enhanced in order to ameliorate risk and vulnerability?

Evidence suggests that chronic, climate-related threats to livelihoods are a greater concern to poor communities than "one-off" disasters and that local cooperation is as important in protecting communities if not more so than material aids. A critical ingredient for reducing vulnerability to disasters is increased resource access and empowerment of marginal groups. These are means to a more secure environment, but they are also the means to more secure livelihoods.

Rationale: While there are many presumed theories of how households and communities adapt to climate change in coastal areas, there are few studies that offer a comprehensive assessment of the interaction between new strategies for economic development and the capacity to adapt over time. This project offers a reliable, comparative, and spatially sensitive research protocol to assess vulnerability that can be applied cross-nationally and cross-culturally in the hope of ameliorating future catastrophes by understanding the root causes and spatial distribution of differential vulnerability and the short- and long-term effectiveness of various coping strategies.

Summary of Work: The project will be implemented over a two-year period beginning in August 2007. The PI and co-PI have worked in the region for more than 20 years and will be able to conduct the proposed research with little lead-time. Data will be collected using a combination of empirical and quantitative research methods. Data will be integrated using participatory techniques to map local level vulnerabilities and will integrate human socioeconomic as well as biophysical data.

B. Objective of Research Project *(Limit to one paragraph)*

Specific project objectives include the following:

- To identify relative vulnerabilities of households and communities

- To determine differential coping and adaptive strategies of households to risks, chronic and crisis climatic events, and natural disasters
- To link vulnerabilities and resilience, that is, to identify connections between risk factors, types of vulnerabilities, capacities and resources.
- To scale up household and community responses by building capacity and ultimately, resilience effectiveness and by advocating changes in policies and practices at all levels.

C. Approach (including methodological framework, models used, theory developed and tested, project monitoring and evaluation criteria) include a description of the key beneficiaries of the anticipated findings of this project (e.g., decision makers in a particular sector/level of government, researchers, private sector, science and resource management agencies) ***(Limit to one page)***

The project is using a dynamic systems model approach to identify the interaction of social and ecological systems in the context of significant climatic crises. The project involves a reliable, comparative, and spatially sensitive research protocol to assess vulnerability that can be applied cross-nationally and cross-culturally in the hope of ameliorating future catastrophes by understanding the root-causes and spatial distribution of differential vulnerability and the short and long-term effectiveness of various coping strategies. The project will be implemented over a two-year period and began August 1, 2007. The data are being collected using a combination of empirical and quantitative research methods and will be integrated using participatory techniques to map local-level vulnerabilities and will integrate human socioeconomic as well as environmental data. Community residents and leaders have been informed of the nature and activities of the project and they have been invited to participate (and many are participating). We are comparing households in three communities all of which are located within the MBRS and are dependent on a variety of livelihood strategies (Mill and Morrison 1985; van der Borg et al. 1991, 1996). WE are taking anthropometric measurements and our main research instrument, the Household Survey, is currently being administered in conjunction with these measurements. The quantitative data are being collected using a panel structure of randomly sampled households in experimental communities. The data will be analyzed at this level as well as in community aggregates. We are aiming for a sample size of a minimum of 10% of all households in each of the three communities, but wehope to obtain a 20-30% sample in at least two of the research sites (Bernard 1996; Salkind 2000). We are drawing our sample in each community using a Probability Proportionate to Size (PPS) technique that involves laying out grids and drawing samples within each grid (Bernard 2006). We have prepared a second randomly selected cohort from which to draw substitutions when designated respondents are not available.

D. Description of any matching funds/activities used in this project ***(Limit to one paragraph)***

Not applicable

II. ACCOMPLISHMENTS

A. **Brief discussion of project timeline and tasks accomplished. Include a discussion of data collected, models developed or augmented, fieldwork undertaken, or analysis and/or evaluation undertaken, workshops held, training or other capacity building activities implemented.** ***(This can be submitted in bullet form – limit to two pages)***

Our project was officially initiated August 1, 2007. The following list provides details, by month, of the main tasks accomplished from 08/01/07 - 04/30/08:

2007 Aug Principal investigators:

1. conducted background research
2. hired Research Assistants
3. coordinated with MBRS Office collaborators

		4. initiated Research Permit process
	Sept	Research Assistants prepare for Field Season 1: background research, immunizations, employment paperwork, etc.
	Oct	Field Season 1 begins: 1. PIs travel to Belize to make contacts in research sites, obtain permission from community leaders, meet with Manager of MBRS Office, secure Research Permit, and conduct training of Research Assistants 2. One-week training of Research Assistants: concepts, approach and methods; data collection; data recording, expense reporting, etc.
	Nov	Research Assistants begin fieldwork -- primarily qualitative data collection and also make contacts and scout out possibilities for Field Assistants for Field Season 2
	Dec	Complete Field Season 1 Begin data processing
2008	Jan	Principal Investigators oversee the following: 1. Team begins analyzing Season 1 data 2. PIs draft Household (HH) Survey 3. Team prepares for Field Season 2 4. Team initiates a data base, using End Notes, to catalog publications, reports, etc., relative to our project
	Feb	Field Season 2 begins: 1. Two week pre-test of HH Survey 2. PI and RAs revise HH Survey according to pre-test results 3. PIs draft Vulnerability and Resilience Indexes
	March	Use PPS sampling method: 1. map communities by grids, count households and draw tier 1 and tier 2 samples 2. HH Survey translated into Spanish 3. Belizean Field Assistants trained to administer the HH Survey and to take anthropometric measurements 4. Meeting with PI to check initial survey data, make final revisions to survey
	April	1. We begin conducting the HH Survey 2. Research and Field Assistants work together for about two weeks to ensure data reliability 3. RAs and FAs conduct HH Surveys. 4. RAs also continue to collect qualitative data and conduct key informant interviews.

B. **Summary of findings, including their potential or actual implications for efforts to develop applications, methods, and science-based decision support capacity/systems and to foster sustainable resource management and vulnerability reduction.** ***(Limit to two pages)***

We focused on two of our project objectives during the first year of the project -- gathering data on the region and country relative to climate issues, vulnerability and resilience; and collecting community and household level data on how residents think about livelihood security, vulnerability and resilience. We used this information to construct the Household Survey that we are currently administering. The following observations are based on preliminary assessments made from our qualitative data collected thus far.

The Macro Picture: This region is subject to a range of climate-related issues and shocks, from prolonged drought to tropical storms and hurricanes and the flooding and mudslides that can result from them. Belize has a long, low-lying coastline, which accommodates 45% of the country's population, ports, and industries. During the last seventy-five years, 19 tropical storms have been recorded in Belize.

One third of these storms reached hurricane category 3 status or higher when making landfall. Hurricane Keith in 2000 had total damage costs in excess of BZ$560 million. Hurricane Iris in 2001 killed 24 people and affected 21,568 others. The storm destroyed 3,178 homes, 19 schools and 12 health posts. In 2007, Hurricane Dean caused over BZ$200 million worth of property damages.

The National Emergency Management Organization (NEMO) was established in Belize in 1999 "to preserve life and property in the event of an emergency, threatened or real, and to mitigate the impact on the country and its people." NEMO, its committees, and NGO partners have worked over the last decade to prepare disaster management plans for each city, town, and village in Belize. The system's early action focuses on evacuation of at-risk populations, and the Damage Assessment and Needs Analysis committee conducts a series of assessments post disaster. A large number of projects and programs complement NEMO's work, including: CDERA, the World Bank, the IDB and CDB, CEPREDENAC, USAID, PAHO, UNICEF, and the Belize Red Cross. The country still struggles with coordination of these various groups in the course of a disaster. Several reports provide detailed analyses of the country's Disaster Mitigation Plans (NPDC 2003; TANGO International 2006) and offer recommendations as to how these groups can more effectively coordinate their efforts.

We have also learned there are a number of national and regional NGOs whose work in various ways relates to vulnerability and climate-related events/shocks. Some of the more important agencies include: the Caribbean Community Climate Change Center (CCCCC), Healthy Reefs/Healthy People, Mainstream Adaptation to Climate Change (MACC), and Special Projects on Adaptation to Climate Change (SPACC) as well as our collaborators, the Mesoamerican Barrier System (MBRS) Project.

The Micro Picture: It is critically important to our project to understand, as baseline data for our indexes, local resident perceptions of livelihood security, vulnerability and resilience. The following is a preliminary discussion of how residents think about these important aspects of their lives. Local residents in our communities associate livelihood security with a number of factors, including home ownership, employment, having children, having the means to school their children, good health, and feeling physically safe in their homes and in their community. Many residents also associate a "peaceful existence" and "being happy" with livelihood security. Their understanding of vulnerability is largely the converse of all of these factors, that is, having no home, having no children, having ill children, domestic conflict, and "being careless with money" and therefore not having a "stable home environment."

While we are still conducting the HH Survey and have no conclusive results at this time regarding resiliency to climate-related events, the following points offer some preliminary observations regarding livelihood security and vulnerability relative to the tourism economies on which these communities depend. Major trends indicated thus far:

1. ***Increased investments and tourist visitation produce economic intensification:***
    - The numbers of residents, businesses, and opportunities to work for cash income grow as tourist visitation increases. This trend is particularly pronounced in two of our research communities, where the tourism economy is well developed.
    - Tourism growth increases the size of the resident population through the arrival of immigrants who settle in host communities.
    - Tourism increases cash income for those immigrants and residents who can invest in their own businesses, and it offers employment to residents (though whether the range of employment opportunities is always beneficial is questionable).
    - Short-run economic benefits accrue unequally within communities, and increasingly so with economic intensification.
    - As tourism grows, and the costs of living increase, families tend to work more and have less time to maintain social relationships and participate in community organizations. A cost of economic security may be reduced social network security.
    - Intensification of tourism in the region has increased the probability of crime, particularly robberies and drug use. Residents believe these problems are related to lack of law enforcement and the presence of “bad people.”

2. ***As investments in tourism businesses increase, we observe a process of economic simplification and the restructuring of the economy.***

- Other economic sectors are displaced, leaving families and communities to rely increasingly on the mono-crop of tourists to finance imports of food and other necessities.
- Food security diminishes as local food production is replaced by food imports. This is shown by increased reliance on food purchases, increased expenditures for food, and in some cases, fewer meals consumed per day.
- Occupational diversity for households is not always increased by growth in tourism. Occupational stability can also decline as tourism grows. Tourism intensification may reduce household economic security through generation of low-paying, part-time, and seasonal work.
- Ecotourism has improved healthcare access for some by providing additional income available for private healthcare services.

3. ***Tourism intensification also results in ecological simplification and environmental degradation.***

- Expansion of urban settlements causes habitat destruction and degradation through road construction, contamination, and the encroachment of hotels, houses, restaurants, and other infrastructure into surrounding areas.
- Intensification of tourism has undermined environmental health in residential areas through removal of vegetation; loss of habitat that drives species into houses and businesses; increased use of pesticides to combat infestations; increased populations of potentially disease-bearing mosquitoes; and contamination with solid waste and gray and brown waters.
- With the exception of Placencia, whose local water supply comes from an artesian well, increased income at the community level has <u>not</u> resulted in a reliable source of clean drinking water in the communities studied. Rather, potable bottled water is available to those who can afford it.
- To varying degrees, the establishment of Protected Areas (PAs) and the presence of certain ecotourism opportunities have increased consciousness of the need for environmental conservation.
- The exclusion of resident populations from access to traditionally used resources threatens the well-being of some resident families.
- Intensification of tourism threatens the carrying capacity of some PAs.

4. As tourist visitation increases, communities experience increased cultural diversification.

- National and international migration increase as tourism intensifies, bringing new cultural and linguistic groups to live in tourism-dependent communities.
- Cultural diversity has the potential to enrich the pool of knowledge and experience in host communities.
- Evidence of increases in the "demonstration effect" suggests cultural loss.

C. List of any reports, papers, publications or presentations arising from this project; please send any reprints of journal articles as they appear in the literature. Indicate whether a paper is formally reviewed and published. ***(No text limit)***

Presentations

1. Alexander, Sara E. and Susan Stonich. 2007. From Vulnerability to Resilience: Helping People and Communities Cope with Climate-related Crises. Presentation to Belize National Symposium on Climate Change, Belize City, November 28.
2. Alexander, Sara E. and Susan Stonich. 2008. Invited Session. From Vulnerability to Resilience: Tourism and Climate Change in the Mesoamerican Barrier Reef. Session to be presented at the 6th annual meeting of INTERNACIONAL DE TURISMO EN EL CARIBE, June 26-28, Cozumel.

3. Alexander, Sara E. 2008. Developing an Index to Measure Vulnerability and Resilience: Helping Communities Cope with Climate-related Crises in the Mesoamerican Barrier Reef Region. Paper to be presented at the 6th annual meeting of INTERNACIONAL DE TURISMO EN EL CARIBE, June 26-28, Cozumel.
4. Stonich, Susan. 2008. Tourism as Economic Development in an Era of Climate Change: The Case of Coastal Belize. Paper to be presented at the 6th annual meeting of INTERNACIONAL DE TURISMO EN EL CARIBE, June 26-28, Cozumel.
5. Cole, Stephen. 2008. The Impacts of Tourism and Climate on Human Health in Poor Communities on Ambergris Caye, Belize. Paper to be presented at the 6th annual meeting of INTERNACIONAL DE TURISMO EN EL CARIBE, June 26-28, Cozumel.
6. Haas, Jonah. 2008. An Evaluation of Volunteer Tourism as a Means of Reducing Vulnerability and Increasing Resilience in Tourism Dependent Coastal Communities in Belize. Paper to be presented at the 6th annual meeting of INTERNACIONAL DE TURISMO EN EL CARIBE, June 26-28, Cozumel.
7. McAllister, Lisa. 2008. The Effects of Climate change and Increasing Economic Dependence on Tourism on Reproductive Decision Making Across Three Belizean Coastal Communities. Paper to be presented at the 6th annual meeting of INTERNACIONAL DE TURISMO EN EL CARIBE, June 26-28, Cozumel.
8. Alexander, Sara E. and Sara E. Alexander. 2008. Developing an Index to Measure Resilience: Helping Communities Cope with Climate-related Crises in the Mesoamerican Barrier Reef Region. Paper to be presented at the annual meeting of the American Anthropological Association, San Francisco, November.

A session based on our project's research is planned for the Spring 2009 annual meeting of the Society for Applied Anthropology, Santa Fe.

D. Discussion of any significant deviations from proposed workplan (e.g., shift in priorities following consultation with program manager, delayed fieldwork due to late arrival of funds, obstacles encountered during the course of the project that have impacted outcome delivery). ***(Limit to one paragraph)***

Given that our project start up date was delayed two months, we made adjustments in the timing of our first Field Season. It was originally scheduled for 3 months; we effectively reduced it to two months. We were, however, able to conduct part of the work from the U.S. before departure so we do not feel the project was seriously compromised by this adjustment.

E. Where appropriate, describe the climate information products and forecasts considered in your project (both NOAA and non-NOAA); identify any specific feedback on the NOAA products that might be helpful for improvement. (bulleted response)

The following sources provide climate forecasts and information on climate change that has been particularly helpful:

FAO. 2007. *Climate Change and Food Security: A Framework Document*. Rome: FAO.

IDB. 2003. *Adaptation to Climate Change and Managing Disaster Risk in the Caribbean and South-East Asia*. St. Michael, Barbardos: CDERA.

IPCC. 2007 *Climate Change 2007: AR4 Synthesis Report*. Geneva, Switzerland: UNEP and WMO.

2007 *Working Group 1 Report: The Physical Science Basis*. Geneva, Switzerland: UNEP and WMO.

2007 *Working Group 2 Report: Impacts, Adaptation and Vulnerability*. Geneva, Switzerland: UNEP and WMO.

2007 Working *Group 3 Report: Mitigation and Climate Change*. Geneva, Switzerland: UNEP and WMO.
NOAA. 2008 Climate Prediction Center. www.cpc.ncep.noaa.gov/products/forecasts
NOAA. 2008 Observing Climate Variability and Change. www.noaa.gov/climate/t_observing.html
UNDP. 2008. *Fighting Climate Change: Human Solidarity in a Divided World*. Human Development Report 2007/08. New york, NY: UNDP.
Watson, R.T., M.C. Zinyowera, R.H. Moss, eds. 1997. The Regional Impacts of Climate Change: An Assessment of Vulnerability. Cambridge University Press, UK.
WHO, WMO, UNEP. 2003. Climate Change and Human Health -- Risks and Responses. Geneva: WHO.

III. GRAPHICS: PLEASE INCLUDE THE FOLLOWING GRAPHICS AS ATTACHMENTS TO YOUR REPORT

A. One Power point slide depicting the overall project framework/approach/results to date
B. If appropriate, additional graphic(s) or presentation(s) depicting any key research results thus far
C. Photographs (if easy to obtain) from fieldwork to depict study information (if applicable).

IV. WEBSITE ADDRESS FOR FURTHER INFORMATION (IF APPLICABLE)

Not applicable

V. ADDITIONAL RELEVANT INFORMATION NOT COVERED UNDER THE ABOVE CATEGORIES.

None